

# BLF4G22-100; BLF4G22S-100

UHF power LDMOS transistor

Rev. 01 — 10 January 2006

Product data sheet

## 1. Product profile

### 1.1 General description

100 W LDMOS power transistor for base station applications at frequencies from 2000 MHz to 2200 MHz.

**Table 1: Typical performance**

$T_{case} = 25\text{ }^{\circ}\text{C}$ ; in a common source class-AB test circuit;  $I_{DQ} = 900\text{ mA}$ ; typical values

| Mode of operation       | f<br>(MHz)                  | V <sub>DS</sub><br>(V) | P <sub>L</sub><br>(W) | G <sub>p</sub><br>(dB) | $\eta_D$<br>(%) | IMD3<br>(dBc) | ACPR<br>(dBc) |
|-------------------------|-----------------------------|------------------------|-----------------------|------------------------|-----------------|---------------|---------------|
| 2-carrier<br>W-CDMA [1] | $f_1 = 2135$ ; $f_2 = 2145$ | 28                     | 25 (AV)               | 13.5                   | 26              | -37           | -41           |

[1] 10 MHz carrier spacing PAR 7 dB at 0.01 % probability on CCDF, 3GPP test model 1, 1 to 64 DPCH.

#### CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

### 1.2 Features

- Typical 2-Carrier W-CDMA performance at a supply voltage of 28 V and an  $I_{DQ}$  of 900 mA:
  - ◆ Load power = 25 W (AV)
  - ◆ Gain = 13.5 dB (typ)
  - ◆ Efficiency = 26 % (typ)
  - ◆ ACPR = -41 dBc (typ)
  - ◆ IMD3 = -37 dBc (typ)
- Easy power control
- Integrated ESD protection
- Excellent ruggedness > 10 : 1 VSWR at 100 W CW
- High efficiency
- High peak power capability (> 150 W)
- Excellent thermal stability
- Designed for broadband operation (2000 MHz to 2200 MHz)
- Internally matched for ease of use

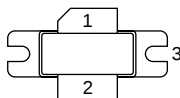
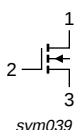
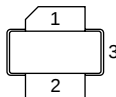
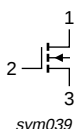
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### 1.3 Applications

- RF power amplifiers for W-CDMA base stations and multicarrier applications in the 2000 MHz to 2200 MHz frequency range.

## 2. Pinning information

Table 2: Pinning

| Pin                    | Description | Simplified outline                                                                   | Symbol                                                                                         |
|------------------------|-------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| BLF4G22-100 (SOT502A)  |             |                                                                                      |                                                                                                |
| 1                      | drain       |   | <br>sym039  |
| 2                      | gate        |                                                                                      |                                                                                                |
| 3                      | source      |                                                                                      |                                                                                                |
| BLF4G22S-100 (SOT502B) |             |                                                                                      |                                                                                                |
| 1                      | drain       |  | <br>sym039 |
| 2                      | gate        |                                                                                      |                                                                                                |
| 3                      | source      |                                                                                      |                                                                                                |

[1] Connected to flange

## 3. Ordering information

Table 3: Ordering information

| Type number  | Package |                                                           |         |
|--------------|---------|-----------------------------------------------------------|---------|
|              | Name    | Description                                               | Version |
| BLF4G22-100  | -       | flanged LDMOST ceramic package; 2 mounting holes; 2 leads | SOT502A |
| BLF4G22S-100 | -       | earless flanged LDMOST ceramic package; 2 leads           | SOT502B |

## 4. Limiting values

Table 4: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol    | Parameter            | Conditions | Min  | Max  | Unit |
|-----------|----------------------|------------|------|------|------|
| $V_{DS}$  | drain-source voltage |            | -    | 65   | V    |
| $V_{GS}$  | gate-source voltage  |            | -0.5 | +15  | V    |
| $I_D$     | drain current        |            | -    | 12   | A    |
| $T_{stg}$ | storage temperature  |            | -65  | +150 | °C   |
| $T_j$     | junction temperature |            | -    | 200  | °C   |

## 5. Thermal characteristics

**Table 5: Thermal characteristics**

| Symbol           | Parameter                                | Conditions                                                                             | Min | Typ  | Max  | Unit |
|------------------|------------------------------------------|----------------------------------------------------------------------------------------|-----|------|------|------|
| $R_{th(j-case)}$ | thermal resistance from junction to case | $T_{case} = 80\text{ }^{\circ}\text{C}$ ;<br>$P_L = 25\text{ W}$ ;<br>2-carrier W-CDMA | -   | 0.76 | 0.85 | K/W  |

## 6. Characteristics

**Table 6: Characteristics**

$T_j = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

| Symbol        | Parameter                        | Conditions                                                             | Min | Typ  | Max | Unit          |
|---------------|----------------------------------|------------------------------------------------------------------------|-----|------|-----|---------------|
| $V_{(BR)DSS}$ | drain-source breakdown voltage   | $V_{GS} = 0\text{ V}$ ; $I_D = 0.9\text{ mA}$                          | 65  | -    | -   | V             |
| $V_{GS(th)}$  | gate-source threshold voltage    | $V_{DS} = 10\text{ V}$ ; $I_D = 180\text{ mA}$                         | 2.5 | 3.1  | 3.5 | V             |
| $V_{GSq}$     | gate-source quiescent voltage    | $V_{DS} = 28\text{ V}$ ; $I_D = 900\text{ mA}$                         | 2.7 | 3.2  | 3.7 | V             |
| $I_{DSS}$     | drain leakage current            | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 28\text{ V}$                         | -   | -    | 3   | $\mu\text{A}$ |
| $I_{DSX}$     | drain cut-off current            | $V_{GS} = V_{GS(th)} + 6\text{ V}$ ;<br>$V_{DS} = 10\text{ V}$         | 27  | 30   | -   | A             |
| $I_{GSS}$     | gate leakage current             | $V_{GS} = 15\text{ V}$ ; $V_{DS} = 0\text{ V}$                         | -   | -    | 300 | nA            |
| $g_{fs}$      | transfer conductance             | $V_{DS} = 10\text{ V}$ ; $I_D = 10\text{ A}$                           | -   | 9.0  | -   | S             |
| $R_{DS(on)}$  | drain-source on-state resistance | $V_{GS} = V_{GS(th)} + 6\text{ V}$ ;<br>$I_D = 6\text{ A}$             | -   | 0.09 | -   | $\Omega$      |
| $C_{rs}$      | feedback capacitance             | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 28\text{ V}$ ;<br>$f = 1\text{ MHz}$ | -   | 2.5  | -   | pF            |

## 7. Application information

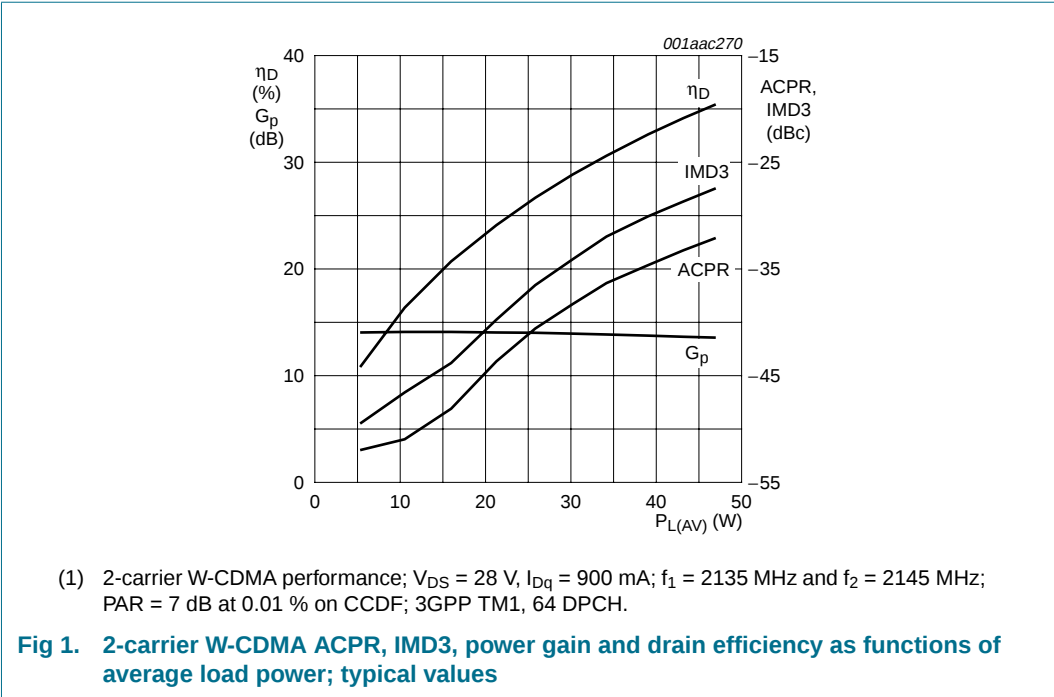
**Table 7: Application information**

Mode of operation: 2-Carrier W-CDMA, PAR 7 dB at 0.01 % probability on CCDF, 3GPP test model 1, 1-64 DPCH,  $f_1 = 2112.5\text{ MHz}$ ,  $f_2 = 2122.5\text{ MHz}$ ,  $f_3 = 2157.5\text{ MHz}$ ,  $f_4 = 2167.5\text{ MHz}$ .

| Symbol   | Parameter                              | Conditions                | Min  | Typ  | Max | Unit |
|----------|----------------------------------------|---------------------------|------|------|-----|------|
| $G_p$    | power gain                             | $P_{L(AV)} = 25\text{ W}$ | 12.5 | 13.5 | -   | dB   |
| IRL      | input return loss                      | $P_{L(AV)} = 25\text{ W}$ | 9    | 15   | -   | dB   |
| $\eta_D$ | drain efficiency                       | $P_{L(AV)} = 25\text{ W}$ | 24   | 26   | -   | %    |
| IMD3     | third order intermodulation distortion | $P_{L(AV)} = 25\text{ W}$ | -    | -37  | -35 | dBc  |
| ACPR     | adjacent channel power ratio           | $P_{L(AV)} = 25\text{ W}$ | -    | -41  | -39 | dBc  |

### 7.1 Ruggedness in class-AB operation

The BLF4G22-100/BLF4G22S-100 are capable of withstanding a load mismatch corresponding to VSWR > 10 : 1 through all phases under the following conditions:  $V_{DS} = 28\text{ V}$ ;  $I_{Dq} = 900\text{ mA}$ ;  $P_L = 100\text{ W}$  (CW).



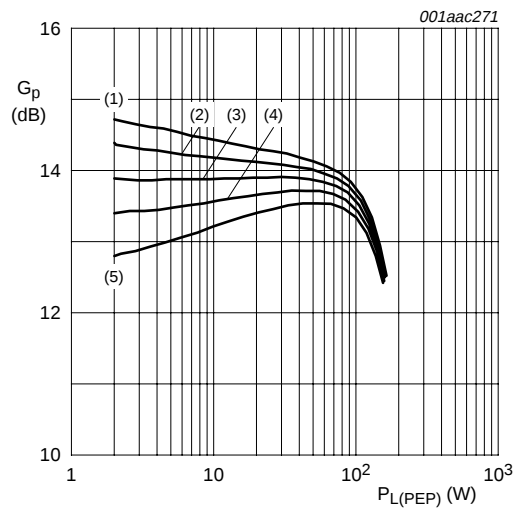
**Table 8: Typical impedance values**  
 $V_{DS} = 28\text{ V}$ ;  $I_{DQ} = 900\text{ mA}$ ;  $P_L = 25\text{ W (AV)}$ ;  $T_{case} = 25\text{ }^{\circ}\text{C}$ .

| Frequency (MHz) | $Z_S$ ( $\Omega$ ) | $Z_L$ ( $\Omega$ ) |
|-----------------|--------------------|--------------------|
| 2110            | $2.2 + j4.8$       | $1.5 - j2.6$       |
| 2140            | $2.2 + j4.6$       | $1.5 - j2.4$       |
| 2170            | $2.2 + j4.5$       | $1.4 - j2.2$       |

**Table 9: RF gain grouping**

| Code [1] | Gain (dB) [2] |      |
|----------|---------------|------|
|          | Min           | Max  |
| A        | 12.5          | 13.0 |
| B        | 13.0          | 13.5 |
| C        | 13.5          | 14.0 |
| D        | 14.0          | 14.5 |
| E        | 14.5          | -    |

[1] 0.2 dB overlap is allowed for measurement reproducibility.  
[2] For 2-carrier W-CDMA at  $f_1 = 2157\text{ MHz}$ ,  $f_2 = 2167.5\text{ MHz}$ .

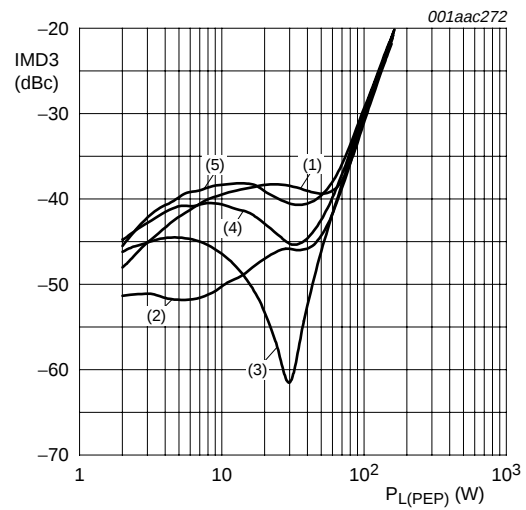


- (1)  $I_{DQ} = 600 \text{ mA}$
- (2)  $I_{DQ} = 750 \text{ mA}$
- (3)  $I_{DQ} = 900 \text{ mA}$
- (4)  $I_{DQ} = 1050 \text{ mA}$
- (5)  $I_{DQ} = 1200 \text{ mA}$

Two-tone measurement;

$V_{DS} = 28 \text{ V}$ ;  $f_1 = 2140.0 \text{ MHz}$ ;  $f_2 = 2140.1 \text{ MHz}$

**Fig 2. Power gain as a function of peak envelope load power; typical values**

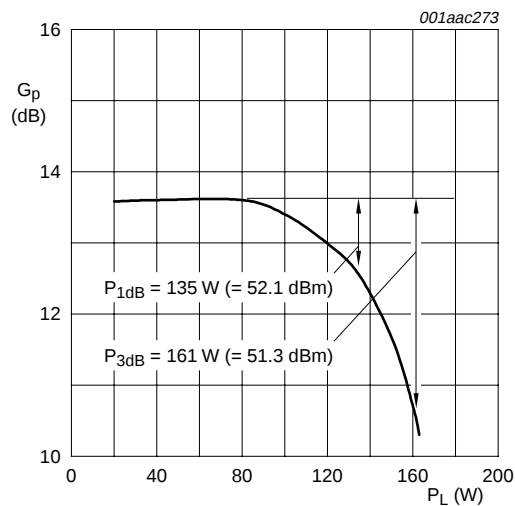


- (1)  $I_{DQ} = 600 \text{ mA}$
- (2)  $I_{DQ} = 750 \text{ mA}$
- (3)  $I_{DQ} = 900 \text{ mA}$
- (4)  $I_{DQ} = 1050 \text{ mA}$
- (5)  $I_{DQ} = 1200 \text{ mA}$

Two-tone measurement;

$V_{DS} = 28 \text{ V}$ ;  $f_1 = 2140.0 \text{ MHz}$ ;  $f_2 = 2140.1 \text{ MHz}$

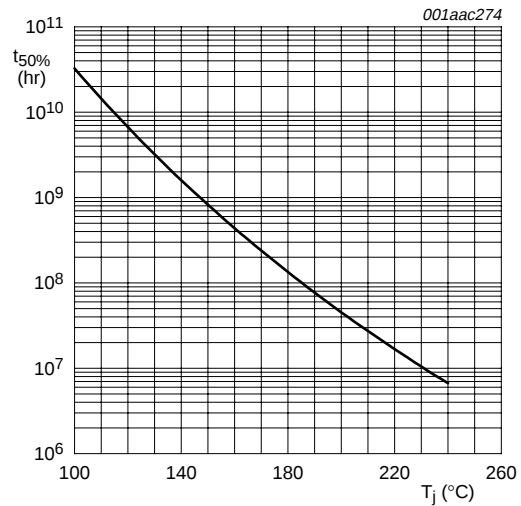
**Fig 3. Third order intermodulation distortion as a function of peak envelope power; typical values**



$t_{on} = 8 \mu\text{s}$

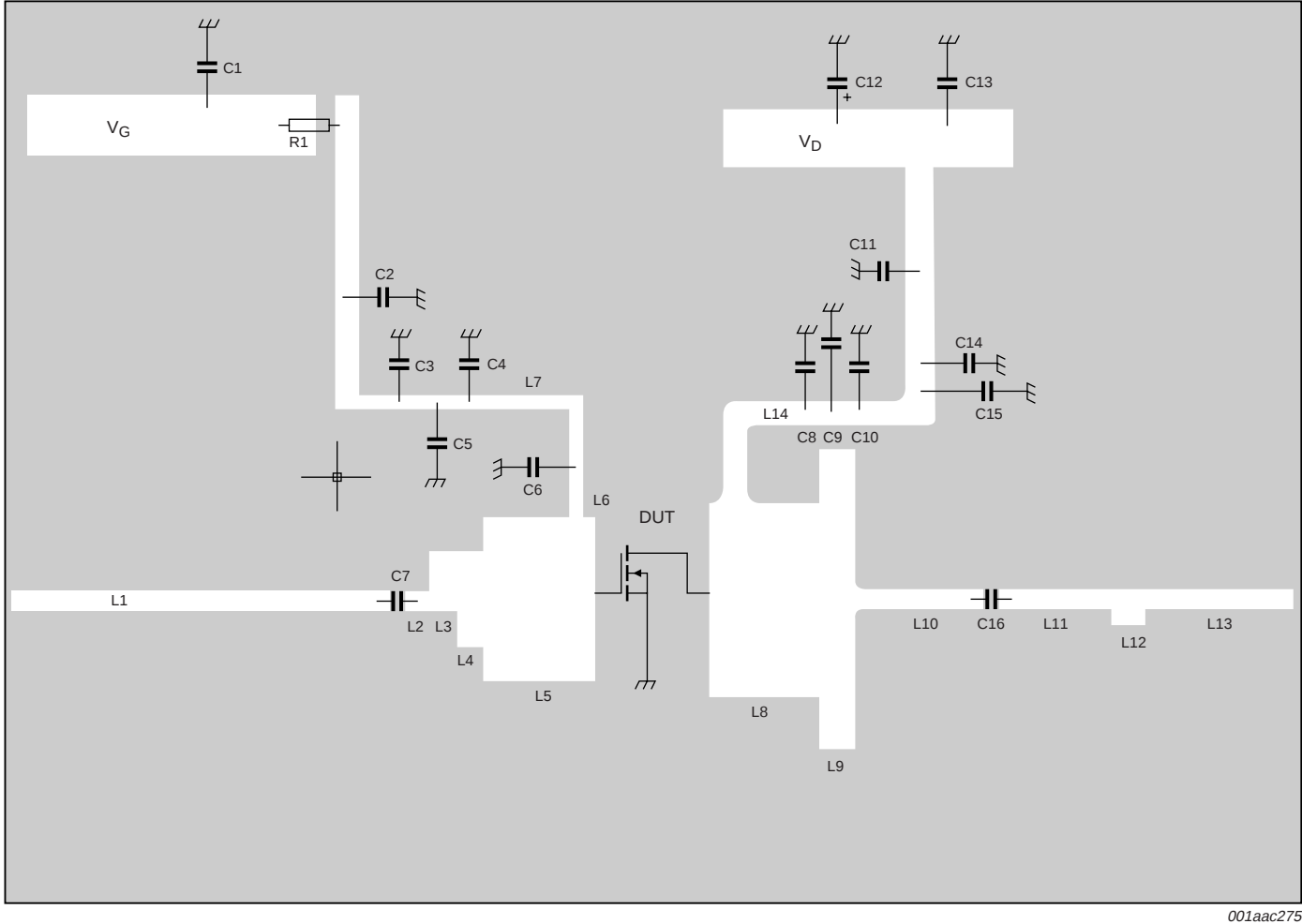
$t_{off} = 1 \text{ ms}$

**Fig 4. Pulsed peak power capability; typical values**



**Fig 5.  $t_{50\%}$  failures due to electromigration as a function of junction temperature**

# 8. Test information



001aac275

See [Table 10](#) for list of components

**Fig 6.** Test circuit for operation at 2.14 GHz



**Fig 7. Component layout for 2.14 GHz test circuit**

Table 10: List of components (see [Figure 6](#) and [Figure 7](#) )

| Component        | Description                       | Value                  | Dimensions                             |
|------------------|-----------------------------------|------------------------|----------------------------------------|
| C1, C2, C11      | tantalum capacitor                | 10 $\mu$ F; 35 V       |                                        |
| C3               | multilayer ceramic chip capacitor | 4.7 $\mu$ F; 25 V      |                                        |
| C4, C10          | multilayer ceramic chip capacitor | [1] 8.2 pF             |                                        |
| C5, C8, C14, C15 | multilayer ceramic chip capacitor | 1.5 $\mu$ F; 50 V      |                                        |
| C6               | multilayer ceramic chip capacitor | [2] 0.6 pF             |                                        |
| C7               | multilayer ceramic chip capacitor | [1] 4.7 pF             |                                        |
| C9               | multilayer ceramic chip capacitor | 220 nF; 50 V           |                                        |
| C12              | electrolytic capacitor            | 220 $\mu$ F; 63 V      |                                        |
| C13              | tantalum capacitor                | 4.7 $\mu$ F; 50 V      |                                        |
| C16              | multilayer ceramic chip capacitor | [3] 7.5 pF             |                                        |
| L1               | stripline                         | [4] $Z_0 = 50 \Omega$  | (W $\times$ L) 32.3 mm $\times$ 1.7 mm |
| L2               | stripline                         | [4] $Z_0 = 50 \Omega$  | (W $\times$ L) 2.2 mm $\times$ 1.7 mm  |
| L3               | stripline                         | [4] $Z_0 = 24 \Omega$  | (W $\times$ L) 2.3 mm $\times$ 4.8 mm  |
| L4               | stripline                         | [4] $Z_0 = 15 \Omega$  | (W $\times$ L) 2.4 mm $\times$ 8 mm    |
| L5               | stripline                         | [4] $Z_0 = 9.5 \Omega$ | (W $\times$ L) 9.3 mm $\times$ 14 mm   |
| L6               | stripline                         | [4] $Z_0 = 60 \Omega$  | (W $\times$ L) 4 mm $\times$ 1.2 mm    |
| L7               | stripline                         | [4] $Z_0 = 60 \Omega$  | (W $\times$ L) 14.5 mm $\times$ 1.2 mm |
| L8               | stripline                         | [4] $Z_0 = 8.2 \Omega$ | (W $\times$ L) 9.3 mm $\times$ 16.8 mm |
| L9               | stripline                         | [4] $Z_0 = 5.5 \Omega$ | (W $\times$ L) 3 mm $\times$ 25.8 mm   |
| L10              | stripline                         | [4] $Z_0 = 50 \Omega$  | (W $\times$ L) 11 mm $\times$ 1.7 mm   |
| L11              | stripline                         | [4] $Z_0 = 50 \Omega$  | (W $\times$ L) 9.5 mm $\times$ 1.7 mm  |
| L12              | stripline                         | [4] $Z_0 = 34 \Omega$  | (W $\times$ L) 3 mm $\times$ 3 mm      |
| L13              | stripline                         | [4] $Z_0 = 50 \Omega$  | (W $\times$ L) 12.7 mm $\times$ 1.7 mm |
| L14              | stripline                         | [4] $Z_0 = 43 \Omega$  | (W $\times$ L) 13.5 mm $\times$ 2.1 mm |
| R1               | SMD resistor                      | 4.7 $\Omega$ ; 0.1 W   |                                        |

[1] American Technical Ceramics type 100B or capacitor of same quality.

[2] American Technical Ceramics type 100A or capacitor of same quality.

[3] American Technical Ceramics type 180R or capacitor of same quality.

[4] Striplines are on a double copper-clad Taconic RF35 PCB ( $\epsilon_r = 3.5$ ); thickness = 0.76 mm.

9. Package outline

Flanged LDMOST ceramic package; 2 mounting holes; 2 leads

SOT502A

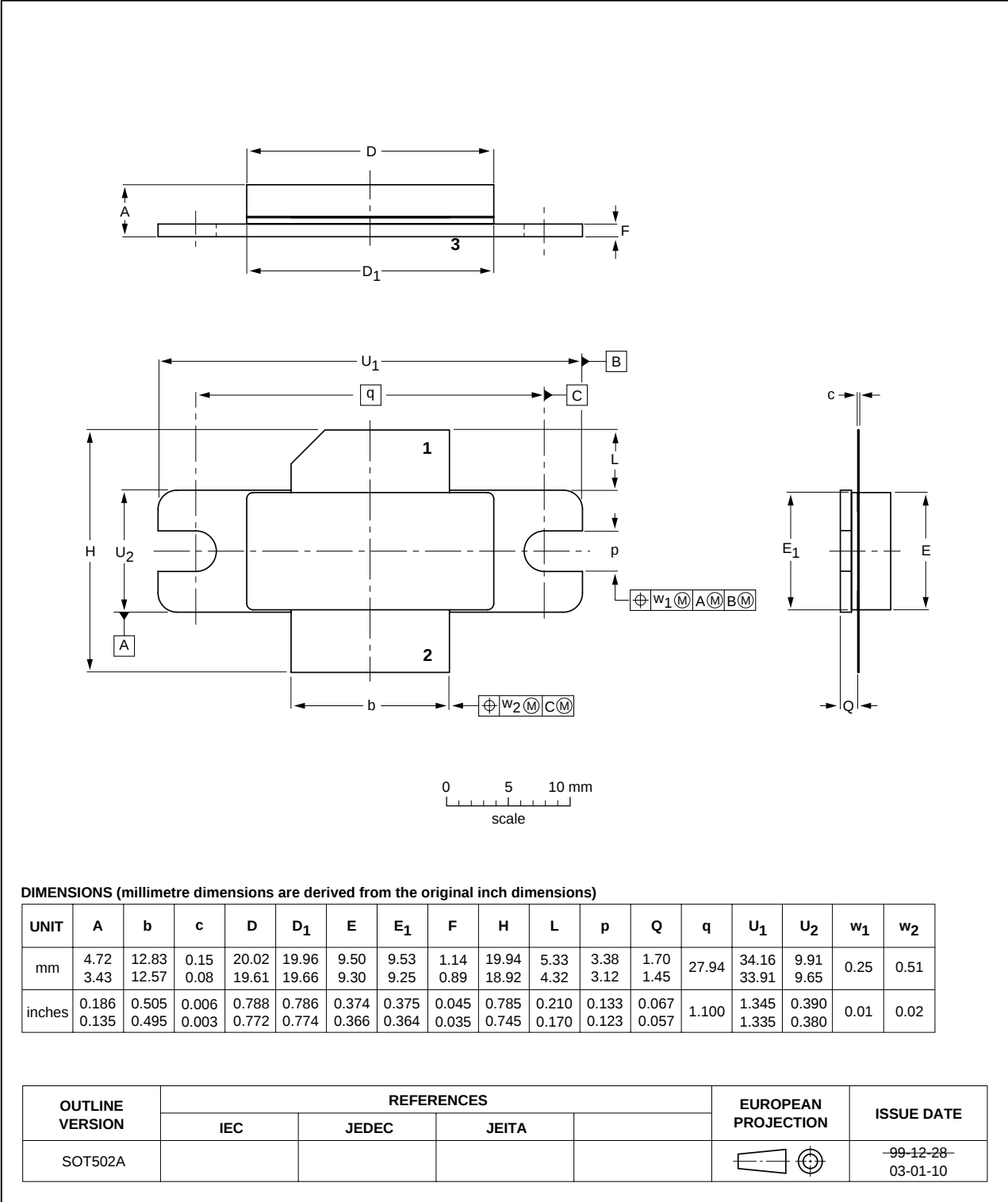


Fig 8. Package outline SOT502A

Earless flanged LDMOST ceramic package; 2 leads

SOT502B

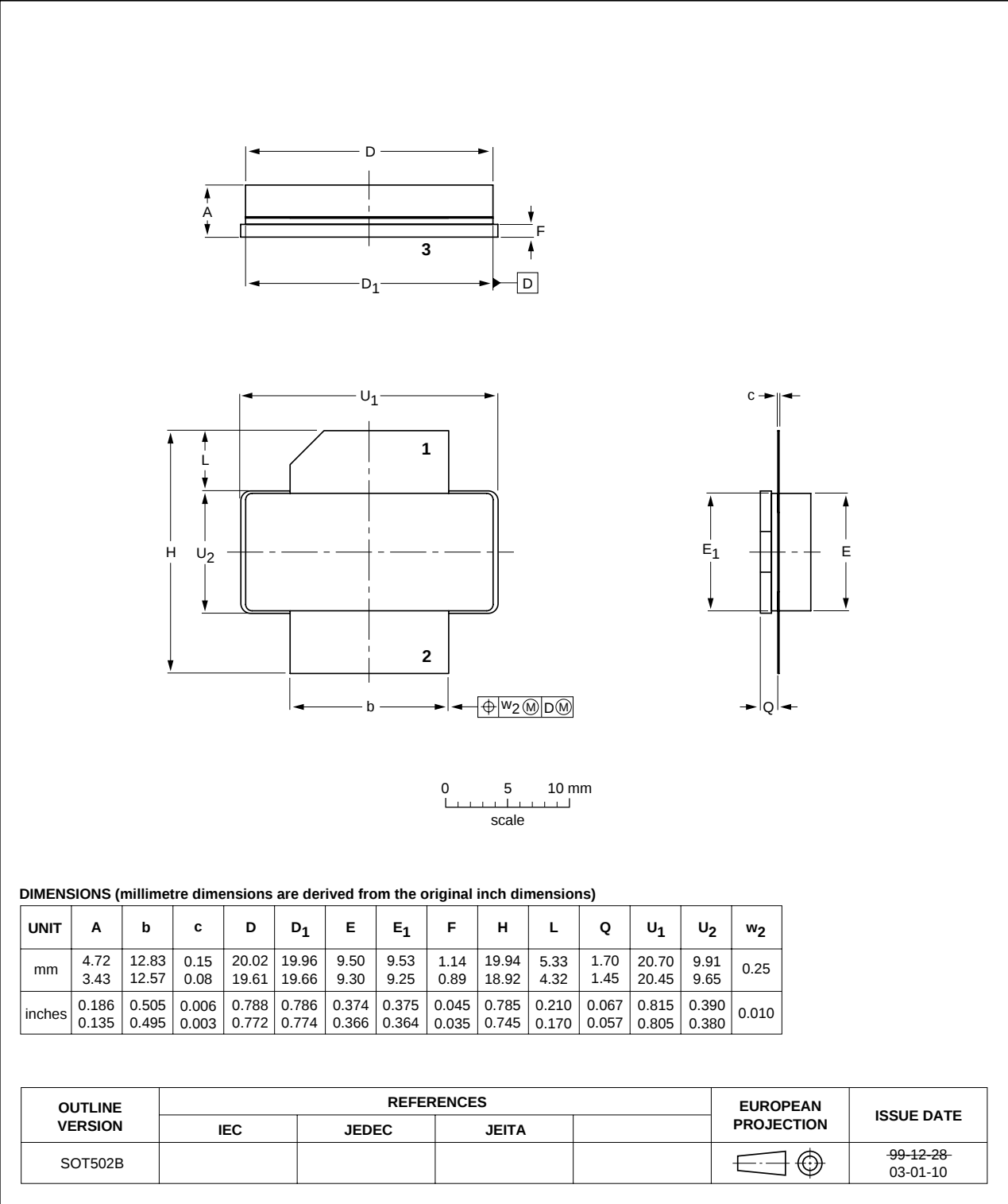


Fig 9. Package outline SOT502B

## 10. Abbreviations

**Table 11: Abbreviations**

| Acronym  | Description                                    |
|----------|------------------------------------------------|
| 3GPP     | Third Generation Partnership Project           |
| CW       | Continuous Wave                                |
| CCDF     | Complementary Cumulative Distribution Function |
| DPCH     | Dedicated Physical Channels                    |
| $I_{Dq}$ | quiescent drain current                        |
| LDMOS    | Laterally Diffused Metal Oxide Semiconductor   |
| PAR      | Peak-to-Average Ratio                          |
| PEP      | Peak Envelope Power                            |
| RF       | Radio Frequency                                |
| TM1      | Test Model 1                                   |
| VSWR     | Voltage Standing Wave Ratio                    |
| W-CDMA   | Wideband Code Division Multiple Access         |

11. Revision history

Table 12: Revision history

| Document ID                 | Release date | Data sheet status  | Change notice | Doc. number    | Supersedes |
|-----------------------------|--------------|--------------------|---------------|----------------|------------|
| BLF4G22-100_4G22<br>S-100_1 | 20060110     | Product data sheet | -             | 9397 750 14338 | -          |

## 12. Data sheet status

| Level | Data sheet status <sup>[1]</sup> | Product status <sup>[2] [3]</sup> | Definition                                                                                                                                                                                                                                                                                     |
|-------|----------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I     | Objective data                   | Development                       | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.                                                                                                    |
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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17. Contents

1 Product profile ..... 1

1.1 General description..... 1

1.2 Features ..... 1

1.3 Applications ..... 2

2 Pinning information..... 2

3 Ordering information..... 2

4 Limiting values..... 2

5 Thermal characteristics..... 3

6 Characteristics..... 3

7 Application information..... 3

7.1 Ruggedness in class-AB operation..... 3

8 Test information..... 6

9 Package outline ..... 9

10 Abbreviations..... 11

11 Revision history..... 12

12 Data sheet status..... 13

13 Definitions ..... 13

14 Disclaimers..... 13

15 Trademarks..... 13

16 Contact information ..... 13



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